ATTACHMENT 8 - ECONOMIC ANALYSIS — WATER QUALITY AND OTHER BENEFITS

Santa Clarita Valley Water Use Efficiency Program (CLWA-4)

Summary

The Santa Clarita Valley Water Use Efficiency Strategic Plan (SCV WUE Plan) identifies programs and projects that will most effectively reduce per capita water use in the Santa Clarita Valley. The Santa Clarita Valley Water Use Efficiency Program (CLWA-4) will implement four recommended programs identified in the SCV WUE Plan. These programs are designed to reduce water demand, improve operational efficiency, enhance water supply and improve water quality.

The four programs currently being implemented by this project, and a brief description of each, are listed below.

(1) *Santa Clarita Valley Large Landscape Audit and Incentive Program*: The program will offer water audits, equipment incentives, and water budgeting to public and private sector large landscape sites with high water use.

(2) *Santa Clarita CII Audit and Customized Incentive Program*: The program will offer comprehensive water audits and reporting of cost effective recommendations commercial, industrial and institutional (CII) customers. Customers will be offered rebate incentives based upon the findings of the audit.

(3) *Residential Santa Clarita Valley Landscape Contractor Certification and Weather-Based Irrigation Controller (WBIC) Program*: The program will provide water efficiency training and certification to landscape contractors, maintenance companies and residents in the Santa Clarita Valley. The training will consist of basic irrigation principles, irrigation scheduling, the value of WBICs and guidelines to proper installation and use. After attending training and receiving certification, the participants will be eligible to receive free WBICs and high efficiency nozzles.

(4) *Santa Clarita Valley High Efficiency Toilet (HET) Rebate Program*: The Program will offer $100 rebates to single family and multi-family residential units for the replacement of toilets in homes older than 1992 with a HET.[1] A total of 500 rebates will be available each year.

Table CLWA-4.1 provides an overview of the costs and benefits presented in attachment 7 and 8. The remainder of this attachment discusses the water quality and other benefits, as directed for Attachment 8.

[1]. HET's are designed to use 1.28 gallons per flush on average. Older toilets can use 3.5 or more gallons per flush. (Vickers, 2001).

TABLE CLWA-4.1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$1,645,699
Monetizable Benefits	
Water Supply Benefits	
Avoided Imported Water Costs	$3,405,010
Water Quality and Other Benefits	
Avoided Wastewater Treatment Costs	$187,881
Total Monetizable Benefits	$3,592,891
Quantified Benefit or Cost	**Project Life Total**
Water Quality and Other Benefits	
Avoided Introduction of Chlorides into the Basin	**638 Metric Tons**
Reduced CO_2 Emissions	**3,106 Metric Tons**
Qualitative Benefit or Cost	**Qualitative Indicator***
Water Supply Benefits	+
Increased Water Supply Reliability for CLWA customers	+
Improved Operational Flexibility for CLWA	+
Water Quality and Other Benefits	+
Reduced Pollution from Dry-Weather Runoff	+
Increased Water Conservation Education	+
Reduced Disinfection By-Products Precursors	+
Reduced Stress on the Sacramento-San Joaquin Delta	+
Reduced Street Maintenance Costs	+

O&M = operations and maintenance
CO_2 = carbon dioxide
* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

The "Without Project" Baseline

Four retail water providers in the Santa Clarita Valley are participating in the SCV WUE Plan - Valencia Water Company, Santa Clarita Water Division of CLWA, Newhall County Water District, and Los Angeles County Waterworks District #36. Without the project, these retail water providers will continue to provide potable water to meet outdoor water demand for 2,412 residential and 56 large landscape sites proposed for irrigation efficiency improvements. Additionally, the water purveyors included will continue to provide potable water to meet indoor and outdoor non-potable demand for 126 commercial and industrial customers. Without the project, water savings totaling 6,580 acre-feet (AF) over the project lifetime will not be achieved.

Runoff from overwatering landscapes in the participating agencies' service areas currently ponds in streets and gutters, and runs into local retention basins. Stagnant water in these areas is hard to drain and contributes to mosquito problems. In addition, the runoff contains fertilizers and pesticides that have been applied to the landscapes, along with other pollutants including salts, pathogens, and fecal coliform bacteria. Runoff from excessive irrigation in each of the participating retail water providers eventually drains into the Santa Clara River.

The Santa Clara River is the largest river system in Southern California that remains in a relatively natural state. The river originates on the northern slope of the San Gabriel Mountains in Los Angeles County, traverses Ventura County, and flows into the Pacific Ocean between the cities of San Buenaventura (Ventura) and Oxnard. Municipalities within the watershed include Santa Clarita, Fillmore, Santa Paula, and Ventura (LAWQCB 2006).

Extensive patches of high quality riparian habitat exist along the length of the river and its tributaries. Two endangered fish, the unarmored three-spined stickleback and the steelhead trout, are residents in the river. One of the Santa Clara River's largest tributaries, Sespe Creek, is designated a wild trout stream by the state of California and a wild and scenic river by the United States Forest Service. Piru and Santa Paula Creeks, tributaries to the Santa Clara River, also support steelhead habitat. In addition, the river serves as an important wildlife corridor. The Santa Clara River drains to the Pacific Ocean through a lagoon that supports a large variety of wildlife.

Most of the soils, surface water, and groundwater in the Upper Santa Clara River Watershed contain chloride. Primary sources of chlorides in surface water and groundwater include imported surface water (i.e., SWP supplies), geologic formations through which both surface and groundwater flow and discharges from wastewater plants (i.e., Valencia and Saugus Water Reclamation Plants). Since the 1970s, growth in the Santa Clarita Valley has led to chloride levels that exceed water quality objectives (WQOs) and impair beneficial uses for agricultural supply, and groundwater recharge. As a result of these factors, a total maximum daily load (TMDL) for chlorides has been established for the Watershed.

A TMDL for nutrients also has been established for the Watershed. The Santa Clara River is listed as impaired by ammonia in Reach 3 and by nitrate plus nitrite in Reach 7 on the 2002 303(d) list of impaired water bodies. Reach 7 includes the project area while Reach 3 is downstream in Ventura County.

Water Quality and Other Benefits

The project will provide water quality benefits as well as other benefits. This section provides discussion and details on estimation of these benefits including avoided introduction of additional chlorides into the basin, reduced CO_2 emissions, increased water conservation education, reduced pollution from dry-weather irrigation runoff, reduced disinfection by-product precursors, reduced stress on the Sacramento-San Joaquin Delta, and reduced street maintenance costs.

Avoided Wastewater Treatment Costs

Water savings from the project will result in a reduction in the volume of wastewater to be treated, which in turn, results in avoided wastewater treatment costs. The cost charged by the Santa Clarita Valley Sanitation District to CLWA to receive, treat and discharge wastewater not requiring solids treatment is $550 per AF. It is assumed that this cost will rise at the rate of inflation after 2009, thus remaining constant in real dollars over the life of the project.

This project will only avoid wastewater treatment charges for water saving measures that avoid indoor uses that end up in the sewer system. The HET rebate program and the CII audit and incentive program will result in indoor water savings. However, indoor water use savings could only be separated out for the HET rebate program, while the CII audit and incentive program results in more than just indoor water savings. From project implementation in 2011 until the end of the anticipated lifetime of the water saving services and devices in 2037, 750 AF of wastewater will be avoided from the HET program, with an avoided cost of $187,881 in present-value 2009 dollars.

Avoided Introduction of Additional Chlorides into the Watershed

Reduced demand for imported water as a result of the project will avoid additional accumulation of chlorides in the Watershed. SWP water, which is imported from outside of the Watershed, contains salts, nutrients, and other constituents. When this water is used in the Watershed, some of those salts, nutrients, and other constituents remain behind. Reducing future SWP water imports through conservation efforts will effectively prevent the import of additional salts, including chlorides, and other constituents into the Watershed.

The average chloride concentration in SWP water is approximately 79 milligrams per liter (mg/L) (Metropolitan, 2010). Therefore, each AF of SWP water contains, on average, 0.097 metric tons (MT) of chlorides per AF.[2] By eliminating the future use 6,580 AF of imported SWP water over the 27-year project life, the project will avoid the introduction of about 638 MT of chlorides into the Watershed.

Reduced CO2 Emissions

By reducing imported water demands due to decreased demand, the project will avoid emissions of CO2 (a greenhouse gas) generated by the production of energy required to transport SWP water to CLWA service area.

CO2 emissions resulting from the production of electricity, measured as tons of CO2 per megawatt-hour (MWh), vary by energy source. Hydroelectric power plants are assumed to generate relatively little CO2 emissions, on the order of 0.005 to 0.02 MT/MWh (van de Vate, 2002). For the Pacific region of the United States, CO2 emissions from coal-fired plants and natural gas-powered plants are estimated to be 0.976 MT CO2/MWh and 0.561 MT CO2/MWh, respectively (DOE/EPA, 2000). In California, electricity production relies on a range of energy sources, including those located within California and those located outside of the state. The California Department of Water Resources (DWR) estimates that the CO_2 emissions rate for all electricity sources providing electricity to DWR is 0.325 MT of CO_2/MWh (Climate Registry, 2010).

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[2]. 1 acre-foot = 1,233,482 liters; 97 mg/L = 97,445,078 mg/AF or 0.097 MT/AF.

The California Energy Commission estimates that the electricity required for the conveyance of 1 AF of SWP water to Castaic Lake, where SWP water is stored for later use, is 1.17 MWh[3] (CEC, 2010). When energy requirements for treatment are taken into account, the total amount of energy required for every AF of SWP water delivered to Castaic Lake and treated at Castaic Lake Water Agency (CLWA) treatment plants (for ultimate delivery to SCV WUE Plan water purveyors) amounts to 1.451 MWh.[4]

Using the DWR CO_2 emissions rate of 0.325 MT/MWh, 0.472 MT of CO_2 are produced for every AF of water delivered and treated within the CLWA service area (1.451 MWh/AF multiplied by 0.325 MT/MWh). Thus, by eliminating the use of 6,580 AF of SWP water over the assumed project life, the project will avoid emissions of 3,106 MT of CO_2.

Reduced Pollution from Dry-Weather Irrigation Runoff

Runoff from landscape irrigation is a significant source on non-point source pollution in urban environments. The use of WBICs will reduce runoff from landscapes that are over-watered until soil is supersaturated and/or have a significant amount of overspray onto sidewalks, driveways, streets, and other hard surfaces due to poor design and/or maintenance. This will reduce the resulting dry-weather irrigation runoff, which carries fertilizers, pesticides, and other pollutants (e.g., pathogens, fecal coliform bacteria, salts) into the storm drain system and/or into local creeks and rivers. According to a study conducted by the Municipal Water District of Orange County and the Irvine Ranch Water District (MWDOC and IRWD, 2004), the installation of WBICs reduced runoff by 50% compared to post-intervention runoff and 71% compared to a control group. The study also noted that a reduction in the volume of runoff did not increase the concentration of pollutants in the runoff. This means that the reduction in total pollutants transported through runoff will likely be possible through a reduction in total runoff.

Reduced runoff that will result from this project will also reduce areas of ponded water in gutters and local retention basins, which will lessen problems with mosquitoes in the area.

Increased Water Conservation Education

The project will provide education on the benefits associated with reducing overwatering of lawns and how to reduce irrigation while maintaining healthy lawns by using WBICs and other methods. During landscape irrigation surveys, water customers will be educated about the importance of actively maintaining their irrigation systems, both to reduce water waste and save on their water bills. Customers can also be introduced to their water agency's other water conservation programs during the survey, creating a greater opportunity for water conservation. Due to the uncertainty associated with landscapes that will be selected for the project, it is not possible to accurately predict the number of persons who will benefit from increased water conservation education.

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[3] http://www.energy.ca.gov/research/iaw/industry/water.html

[4] CLWA estimates the energy requirement for treatment to be 0.285 MWh/AF.

Reduced Disinfection By-product Precursors

SWP water has a number of water quality constituents that affect its suitability as a drinking water source. SWP water contains relatively high levels of bromide and total organic carbon (TOC), two elements that are of particular concern to drinking water agencies. Bromide and TOC combine with chemicals used in the water treatment process to form disinfection by-products such as trihalomethanes (THMs), which are strictly regulated under the federal Safe Drinking Water Act. Currently, there are no standards for bromide or TOC in drinking water; however, current levels of bromide and TOC are significantly higher than target levels identified by an expert panel hired by the California Urban Water Agencies (CUWA) of 50 parts per billion (ppb) for bromide and 3 parts per million (ppm) for TOC. Average SWP levels were significantly higher: up to 600% above the target level for bromide and 10% above the target level for TOC (Owen et al., 1998).

Water agencies treat all water to meet stringent state and federal drinking water standards before delivering it to their customers. Water treated by CLWA currently meets all federal and state drinking water standards. However, source water of poor quality makes it increasingly expensive and difficult to meet such standards. Increased levels of constituents that aid in the formation of THMs can mean more time spent monitoring finished water in the distribution systems. Increased levels of these constituents may also lead to the use of increased proportions of groundwater in the blend of water supplies in order to control THMs. However, reduced imports of SWP water will reduce the need for such preventative measures.

Reduced Stress on the Sacramento-San Joaquin Delta

By conserving water used for irrigation, the project will offset future SWP water imports. This water can be left as future instream flows in the Sacramento-San Joaquin Delta or can be used to offset other future diversions that may otherwise reduce flows. Reduced demands on Delta supplies also will help reduce the overall salinity of the Delta and improve Delta habitat.

Maintaining the Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports irrigation of 4.5 million acres of agriculture, and serves as a home to 750 plant and animal species. The Delta's 1,600 square miles of marshes, islands and sloughs support at least half of migratory water birds on the Pacific Flyway, 80 percent of California's commercial fisheries and recreational uses including boating, fishing and windsurfing.

Delta resources are in a state of crisis. Fish populations including salmon and Delta smelt have declined dramatically in recent years. The levee system is aging, and vulnerability of the Delta to flooding, sea-level rise, or a major earthquake have contributed concerns about possible levee collapse which would result in devastating impacts to both water supply and habitat.

Reduced Street Maintenance Costs

The project will reduce street maintenance costs by reducing the amount of dry-weather runoff to streets in the participating agencies' service areas. The project will reduce ponding on streets and minimize the effect of moisture in creating potholes and cracks, which make up a significant portion of street maintenance costs.

Distribution of Project Benefits, and Identification of Beneficiaries

As summarized in Table CLWA-4.2, this project includes the full range of types of beneficiaries. The Santa Clarita Valley Family of Water Suppliers partnered to establish these water use efficiency programs. This group consists of a wholesale supplier (CLWA) and four retail suppliers. At the local and regional level, benefits will accrue to these agencies and their customers while helping meet the statewide goal to reduce per capita urban water use by 20 percent by the year 2020. Reduced demand for water imported from the SWP will have benefits for sensitive ecosystems in the Sacramento-San Joaquin Delta.

TABLE CLWA-4.2
PROJECT BENEFICIARIES SUMMARY

Local	Regional	Statewide
Valencia Water Agency, Santa Clarita Water Division of CLWA, Newhall County Water District, Los Angeles County Waterworks District #36, City of Santa Clarita	Castaic Lake Water Agency, Santa Clarita Valley Sanitation District	Statewide Water Use Efficiency Goal, Sacramento-San Joaquin Delta

Project Benefits Timeline Description

The project will be implemented over a 2-year period, beginning in July of 2011 and ending in July of 2013. A water savings lifespan of 10 years has been identified for the *Large Landscape, CII, and Residential Irrigation* programs. Benefits from these programs are expected to extend over 12 years, which allows for phase-in implementation over the first three years and the phase-out benefits at the end of the project. A water savings lifespan of 25 years has been identified for the *High Efficiency Toilet Program*. Benefits from this program are expected extend over 27 years, which allow for phase-in implementation over the first three calendar years and the phase out of benefits at the end of the program.

To quantify water quality and other benefits by year, it was assumed that the project will be implemented across the timeframe from July 2011 through July 2013. This results in a ramp-up period where approximately 21% of project benefits are realized in 2011, 71% are realized in 2012, and all benefits are realized in 2013. For the three projects with a 10-year lifespan, benefits ramp down in 2021 and 2022. For the *High Efficiency Toilet Program* with the 25-year lifespan, benefits ramp down in 2036 and 2037.

Potential Adverse Effects from the Project

There are no adverse effects anticipated from this project.

Summary of Findings

The project will provide a range of both water quality and other benefits. The water savings associated with high efficiency toilet and urinal installation will avoid the treatment of 750 AF of wastewater, avoiding $187,881 in wastewater treatment costs. By avoiding the use of 6,580 AF of

SWP water through 2037, this project will avoid the introduction of 638 MT of chlorides into Watershed, and avoidance of 3,106 MT of CO_2 emissions.

Additional qualitative benefits from the project include reduced pollution from dry-weather runoff, increased water conservation education, reduced DBP precursors, reduced stress on the Sacramento-San Joaquin Delta, and reduced street maintenance costs. These qualitative benefits and their magnitudes are summarized in Table CLWA-4.3.

TABLE CLWA-4.3
QUALITATIVE BENEFITS SUMMARY – WATER QUALITY AND OTHER BENEFITS

Benefit	Qualitative Indicator
Reduced Pollution from Dry-Weather Runoff	+
Increased Water Conservation Education	+
Reduced Disinfection By-Products Precursors	+
Reduced Stress on the Sacramento-San Joaquin Delta	+
Reduced Street Maintenance Costs	+

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. These issues are listed in Table CLWA-4.4.

TABLE CLWA-4.4
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided Wastewater Treatment Costs	++	Avoided wastewater treatment costs were estimated based on water savings from the HET installation program. However, the CII Audit Program includes the installation of HETs. The savings from the HET portion of the CII Audit Program could not be separately estimated, and as such could not be included in the monetized benefit. Additionally, the lifetime of indoor water use equipment used in the CII program is assumed to be 10 years. A review of the marketplace showed that high efficiency toilet and urinals are 25 years and 33 years respectively. Avoided wastewater costs will be significantly higher than indicated.
Reduced CO_2 Emissions	+	Lifetime of WBICs and high efficiency nozzles is assumed to be 10 years. A review of the marketplace showed that WBIC lifetime could be 15 years (U.S. EPA, 2009). If the longer WBIC lifetime applies then the associated savings from this portion of the project would be greater than shown here. This would result in greater CO_2 emissions reductions.

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Reduced CO_2 Emissions	+	Lifetime of indoor water use equipment used in the CII program is assumed to be 10 years. A review of the marketplace showed that high efficiency toilet and urinals are 25 years and 33 years, respectively. Additionally, commercial high efficiency washers have a lifetime of 16 years (Haasz, 2010). If the longer lifetime applies then the associated savings form this portion of the program would be greater than shown here.
Reduced CO_2 Emissions	+	The energy required to distribute water from CLWA treatment plants to the SCV WUE Plan water purveyors is unknown. The CO_2 emissions reductions associated with these energy requirements are therefore not quantified.
Avoided Introduction of Chlorides into the Basin	+	Lifetime of WBIC and high efficiency nozzles is assumed to be 10 years. A review of the marketplace showed that WBIC lifetime could be 15 years (U.S. EPA, 2009). If the longer WBIC lifetime applies then the associated savings from this portion of the project would be greater than shown here. This would result in greater avoided introduction of chlorides than shown in this analysis.
Avoided Introduction of Chlorides into the Basin	+	Lifetime of indoor water use equipment used in the CII program is assumed to be 10 years. A review of the marketplace showed that high efficiency toilet and urinals are 25 years and 33 years respectively. Additionally, commercial high efficiency washers have a lifetime of 16 years (Haasz, 2010). If the longer lifetime applies, then the associated avoided introduction of chlorides from this portion of the program would be greater than shown here.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

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Santa Clara River-Sewer Trunk Line Relocation Project (Phase 1) (NCWD-3)

Summary

The Newhall County Water District (NCWD) currently maintains a sewer trunk line that is located within the Santa Clara River in the Canyon Country area of the City of Santa Clarita. During large rainfall events, the Santa Clara River swells, causing debris to be swept into the river and dirt to erode around the sewer trunk line, exposing the line. If a large piece of debris, moving at a high rate of speed, hits the sewer trunk line, the line could break. If the sewer trunk line breaks, raw sewage would be released into the river, impacting nearby domestic groundwater wells and the ecosystem. The sewer trunk line has been maintained by the NCWD since its installation in 1968.

Instead of continuing preventative maintenance and extending the life of the line in place, NCWD proposes to remove the sewer trunk line out of the riverbed and into the public right-of-way. Under this grant application, NCWD is requesting funds for Phase 1 of the project, which consists of the planning, engineering, and design of the sewer trunk line relocation. If the results from Phase 1 are acceptable, Phases 2 and 3 will be carried out. Phase 2 involves the removal and relocation of the current gravity feed portion of the sewer trunk line, while Phase 3 consists of the construction of a sewer lift station, forced sewer main, and the remaining gravity feed portion of the sewer trunk line. Phase 3 is scheduled for completion in June 2016. With a 50-year lifetime, the project's assets are expected to provide benefits through May 2066.

The benefits of this project can only be properly evaluated based on the full implementation of all three phases of the project. Therefore, this economic analysis starts by considering the benefits of complete implementation of all three phases of the project, and then apportions a share of the benefits to this initial planning and design phase. The benefits are apportioned based on the percentage of costs for the planning and design phase compared to the costs for full implementation of the project.

A summary of all benefits and costs of the project are provided in Table NCWD-3.1. Project costs and water supply benefits are discussed in the remainder of this attachment.

The "Without Project" Baseline

The Santa Clara River Sewer Trunk Line Relocation Project is located in the Canyon Country section of the City of Santa Clarita within NCWD's service area. Located in the bed of the Santa Clara River, the sewer trunk line is made of vitrified clay pipe (VCP) which was installed in 1968 and has an expected useful life of 50 years. The section that NCWD wishes to relocate out of the riverbed is 750 feet long and has 94 joints. Regardless of their age, when these joints are located in an area where the pipe has been exposed in the river bed, they are susceptible to breaking. Without the project, large debris in large flood events could hit the sewer line and cause a break

The sewer trunk line will reach the end of its expected useful life in 2017. However, in absence of the project, it is assumed that the sewer trunk line would continue to be used beyond 2017. This would result in the need for more than normal periodic replacement of parts due to extend use the pipe more than its assumed 50-year life. To extend use of the existing pipe, NCWD estimates that one section of pipe would need to be replaced every five years beginning in 2017, costing $100,000. One section of pipe stretches from manhole to manhole and is approximately 350 feet.

The Santa Clarita area is subject to large storm events approximately every five years. In 2005, heavy rain caused the volume in the Santa Clara River to increase significantly, ultimately damaging five of the 94 susceptible joints. NCWD has been replacing an average of 5 joints in response to recent large flood events. Replacing 5 joints costs NCWD $100,000. For this analysis, it is assumed that without the project, NCWD will replace 5 joints every 5 years beginning in 2017 at a cost of $100,000 for all joints.

Moreover, if the sewer trunk line were to break with a resulting spill, there would be costs to remove solids discharged into the river and to monitor the river's health. It is assumed that a decent sized release would occur once every ten years beginning in 2017 and cost $50,000 to clean up.

Finally, if the sewer trunk line were to break with a resulting spill, the discharge of raw sewage would have a negative impact on the surrounding ecosystem. Extensive patches of high-quality riparian habitat exist along the length of the Santa Clara River. Two endangered fish, the unarmored three-spined stickleback and the steelhead trout, are resident in the river (LAWQCB, 2010). In addition, the river serves as an important wildlife corridor.

TABLE NCWD-3.1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$202,718
Monetizable Benefits	
Water Supply Benefits	
Avoided Imported Water Supply Costs	$44,117
Water Quality and Other Benefits	
Avoided Costs of Replacing Sections of Existing Sewer Trunk Line	$14,607
Avoided Repair Costs for Existing Pipe	$14,607
Avoided Clean-Up Costs from Sewer Trunk Line Break	$4,180
Total Benefits	$77,511
Quantified Benefit or Cost	**Project Life Total**
Water Quality Benefits	
Ecosystem Benefits	+

O&M = operations and maintenance

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

Water Quality and Other Benefits

The Santa Clara River Sewer Trunk Line Relocation Project will provide several water quality and other benefits, including avoided capital costs associated with replacing sections of the existing sewer trunk line, avoided pipeline repair costs, avoided clean up costs associated with a break in the pipeline, and avoided adverse impacts to the Santa Clara River ecosystem. This section provides discussion of these benefits.

Since there will not be any monetary benefits accrued during the planning in Phase 1, it is necessary to calculate the costs and benefits of the entire project so that some of the overall benefits can be allocated to Phase 1. Allocation of benefits to Phase 1 is based on the ratio of the present value of costs in Phase 1 to the present value of costs for all three phases. That ratio is 0.0622 or 6.22% ($202,718/$3,258,126).

Avoided Costs of Replacing Sections of Existing Sewer Trunk Line

If the full project proceeds, implementation of all phases of the project will avoid the need to replace a section of the pipeline every five years, as assumed in the without-project baseline. NWCD's avoided cost of not having to replace a section of the sewer trunk line is $100,000 every five years beginning in 2017, the last year of the sewer trunk line's expected lifetime. In 2009 dollars, the present value avoided cost over the 50-year project lifetime amounts to $234,766. The share of benefits apportioned to Phase 1 of the project totals $14,607 (6.22% multiplied by $234,766).

Avoided Repair Costs for Existing Pipe

The removal of the sewer trunk line out of the riverbed reduces repair costs because the pipeline joints will not need to be replaced every five years due to damage during heavy storm events. NCWD's avoided cost of not having to replace five joints is $100,000 every five years beginning in 2017. In 2009 dollars, the present value avoided repair cost over the 50-year project life is $234,766. The share of benefits apportioned to Phase 1 of the project totals $14,607 (6.22% multiplied by $234,766).

Avoided Clean-Up Costs from Sewer Trunk Line Break

With the relocation of the sewer trunk line out of the riverbed, the VCP can no longer break, thus eliminating the costs associated with cleaning up the raw sewage released into the river when a break occurs. NCWD's avoided cost of hiring a contractor to cleaning up spills is $50,000 per spill. It is uncertain as to how often a break would occur in pipe that is being utilized past its 50-year expected lifetime through replacement of sections of this pipe every 5 years. It is assumed that spills will occur every ten years beginning in 2017, the last year of the sewer line's expected lifetime. In 2009 dollars, the present value avoided clean up costs associated with the project amount to $67,181 over the 50-year project life. The share of benefits apportioned to Phase 1 of the project totals $4,180 (6.22% multiplied by $67,181).

Ecosystem Benefits

Extensive patches of high-quality riparian habitat exist along the length of the Santa Clara River downstream of the project area. In addition, the river serves as an important wildlife corridor. Without the project, when a raw sewage spill occurs as a result of a break of the sewer line, it will be discharged directly into the river. This would result in short-term adverse effects on the surrounding Santa Clara River ecosystem.

According to the California Natural Diversity Database and the California Native Plant Society, 17 special-status plant species have been recorded as present within the project region (City of Santa Clarita, 2010). This includes 4 species federally listed as endangered. In addition, 26 special-status wildlife species have been recorded within the region, including two endangered fish, the unarmored three-spined stickleback and the steelhead trout, and three other federal endangered species including the southwestern willow flycatcher, yellow-legged frog, and the Arroyo toad. An additional 14 special-status species have been identified as having the potential to occur within the project area (City of Santa Clarita, 2010). Avoiding potential future releases of raw sewage into the riverbed will help protect these species and the habitat on which they depend.

Distribution of Project Benefits and Identification of Beneficiaries

There will be water quality and other benefits on the local and regional levels from the Santa Clara River Sewer Trunk Line Relocation Project. NCWD benefits due to the avoided costs associated with replacing sections of the VCP and repairing joints damaged during heavy rain events. Moreover, NCWD will avoid costs associated with cleaning up the river if the sewer trunk line were to have a break resulting in a spill. The ecosystem surrounding the Santa Clara River also benefits because the removal of the sewer trunk line ensures that raw sewage is not discharged into the river.

TABLE NCWD-3.2
PROJECT BENEFICIARIES SUMMARY

Local	Regional	Statewide
Newhall County Water District	Santa Clara River Ecosystem	--

Project Benefits Timeline Description

Phase 1 of the project is scheduled to be completed in July 2013. All phases of the project are scheduled to be completed in June 2016, although benefits will not assumed to be accrued until 2017. In 2017, if the sewer trunk line has not been relocated out of the riverbed, it is assumed that a section of the VCP would need to be replaced, joints sections would need to be repaired, and a line break would have occurred that results in spilling raw sewage into the river. In this analysis, section replacements and joint repairs are assumed to take place every five years, while sewer trunk line breakages resulting in raw sewage spills occur every ten years. The relocated sewer line is assumed to have a 50-year lifetime, during which avoided costs from the baseline assumptions accrue.

Potential Adverse Effects from the Project

There are no adverse impacts anticipated from this project.

Summary of Findings

The proposed project will provide a range of both water quality and other benefits. After apportioning 6.22% of the benefits of the overall relocation project to Phase 1, the project will result in $14,607 in present value avoided capital costs due to no longer having to replace sections of the existing sewer trunk line. As a result of the project, the NCWD will also avoid $14,607 in repair costs for the existing pipeline, and $4,180 in clean up costs associated with a break in the pipeline. Over the 50-year project life, total present value monetized benefits associated with the project amounts to $33,394. In addition, by avoiding the discharge of raw sewage into the river, the project will avoid adverse impacts to the Santa Clara River ecosystem.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In particular, the analysis has assumed that VCP sections would be replaced every five years, joints would be repaired every five years, and sewer trunk line breaks would occur every ten years, and that all would happen starting in 2017. It is possible that replacements, repairs, and breaks occur more or less frequently or that 2017 is not the first year that they occur. These issues are listed in Table NCWD-3.3.

TABLE NCWD-3.3
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefit	Comment
Avoided Capital Costs of Replacing Sections of Sewer Trunk Line	U	The frequency of section replacement is assumed to be every five years; net benefits would be impacted by more or less frequent replacements.
Avoided Repair Costs for Existing Pipe	U	The frequency of joint repairs is assumed to be every five years; net benefits would be impacted by more or less frequent replacements.
Avoided Clean-Up Costs from Sewer Trunk Line Break	U	The frequency of sewer trunk line breaks resulting in raw sewage spills is assumed to be every ten years; net benefits would be impacted by more or less frequent replacements.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

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Santa Clarita Valley Southern End Recycled Water Project (VWC-1)

Summary

The Santa Clarita Valley Southern End Recycled Water Project will expand the existing Santa Clarita Valley recycled water transmission and distribution system to the southern end of the Santa Clarita Valley in order to supply additional customers within the Valencia Water Company (VWC) service area. The project will provide 910 acre-feet (AF) of recycled water per year to VWC municipal customers for domestic landscape irrigation. The source of this water will be the Valencia Water Reclamation Plant (Valencia WRP), which currently serves as a source of supply for existing Castaic Lake Water Agency (CLWA) and VWC recycled water customers.

The project includes planning, designing, and constructing additional recycled water infrastructure, including various recycled water pipelines and pumping stations. Specific project components include 31,000 linear feet of transmission main, 2 booster stations, and 69 service meter connections.

In the future, the project will potentially serve as a source of recycled water for customers within the Newhall County Water District and Santa Clarita Water Division service areas. Some preliminary designs for the extension of the recycled water system to serve these areas have been developed. However, the benefits and costs of this potential extension of the project are not included in this analysis.

A summary of all benefits and costs of the project is provided in Table VWC-1.1. Water quality and other benefits are discussed in the remainder of this attachment.

The "Without Project" Baseline

The Southern End Recycled Water Project will be located within the City of Santa Clarita, in the Upper Santa Clara River Watershed (Watershed). The Santa Clara River is the largest river system in Southern California that is still in a relatively natural state. The river originates on the northern slope of the San Gabriel Mountains in Los Angeles County, traverses Ventura County, and flows into the Pacific Ocean between the cities of San Buenaventura (Ventura) and Oxnard. Municipalities within the Watershed include Santa Clarita, Fillmore, Santa Paula, and Ventura (LAWQCB, 2006).

Extensive patches of high-quality riparian habitat exist along the length of the river and its tributaries. Two endangered fish, the unarmored stickleback and the steelhead trout, are resident in the river (LAWQCB, 2006). One of the Santa Clara River's largest tributaries, Sespe Creek, is designated a Wild Trout Stream by the State of California and a Wild and Scenic River by the U.S. Forest Service. Piru and Santa Paula creeks, tributaries to the Santa Clara River, also support steelhead habitat. In addition, the river serves as an important wildlife corridor. The Santa Clara River drains to the Pacific Ocean through a lagoon that supports a large variety of wildlife.

TABLE VWC-1.1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$10,974,099
Monetizable Benefits	
Water Supply Benefits	
Avoided Imported Water Supply Costs	$9,061,140
Water Quality Benefits	
Avoided Alternative Water Resources Management (AWRM) Costs	**$6,875,545**
Avoided Fertilizer Costs	**$215,557**
Total Monetizable Benefits	**$16,152,242**
Quantified Benefit or Cost	**Project Life Total**
Water Quality and Other Benefits	
Avoided Chlorides Discharge and Avoided Introduction of Chlorides into the Watershed	11,982 Metric Tons
Reduced CO_2 Emissions	10,731 Metric Tons
Qualitative Benefit or Cost	**Qualitative Indicator***
Water Supply Benefits	
Increased Water Supply Reliability for CLWA customers	+
Improved Operational Flexibility for CLWA	+
Water Quality and Other Benefits	
Reduced DBP Precursors	+
Reduced Stress on the Sacramento-San Joaquin Delta	+

CO_2 = carbon dioxide.
DPB = disinfection by-product.
O&M = operations and maintenance.
* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

The predominant land uses in the Watershed include agriculture, open space, and residential uses. Revenue from the agricultural industry within the Watershed is estimated at more than $700 million annually. Residential use is increasing rapidly both in the upper and lower watersheds. The population within the Santa Clarita Valley alone is expected to grow from 187,172 in 1998 to more than 350,000 by 2025 (SCAG, 2009).

Most of the soils, surface water, and groundwater in the Watershed contain moderately high levels of chloride. Primary sources of chlorides in surface water and groundwater include imported surface water [i.e., State Water Project (SWP) supplies], local geologic formations and discharges from wastewater plants (i.e., Valencia and Saugus water reclamation plants).5 Since the 1970s, growth in the Santa Clarita Valley has led to chloride levels that exceed water quality objectives (WQOs) and impair beneficial uses for agricultural supply and groundwater recharge. As a result of these factors, a total maximum daily load (TMDL) for chlorides has been established for the Watershed.

Currently, the Valencia WRP discharges wastewater effluent directly into the Santa Clara River. Due to requirements associated with the established TMDL for chloride, the Santa Clarita Valley Sanitation District (SCVSD) will face penalties for continued discharging wastewater to the river unless source control measures are implemented to reduce chloride levels in Valencia WRP influent and/or the effluent is highly treated using advanced treatment technologies [i.e., through microfiltration/reverse osmosis (MF/RO)] prior to discharge. Both of these measures are included as components of the current AWRM, which was developed to address WQOs associated with the Upper Santa Clara River (USCR) Chloride TMDL.

By providing an alternative to discharge through the use of recycled water, the Southern End Recycled Water Project will reduce the amount of water that would be treated or managed via the AWRM. This will help to reduce costs associated with the planned project. In addition, reduced future reliance on SWP water as a result of the project will (1) reduce CO2 emissions associated with the production of SWP water, (2) reduce the importation of chlorides and other potentially harmful water quality constituents into the Watershed, and (3) result in ecological benefits for the Sacramento-San Joaquin Delta ecosystem. The use of recycled water for irrigation in lieu of potable water will also reduce fertilizer costs for domestic landscape irrigation; recycled water typically contains fertilizing nutrients (e.g., nitrate, phosphorus, and potassium) that are not found in potable water.

Water Quality and Other Benefits

The project will provide a range of water quality and other benefits. This section provides discussion and details on benefit estimation for benefits including avoided wastewater treatment costs (i.e., reduced AWRM costs), avoided fertilizer costs, avoided introduction of additional chlorides into the Watershed, removal of chlorides from effluent discharge, reduced CO_2 emissions, reduced DPB precursors, and ecological benefits in the Sacramento-San Joaquin Delta.

Avoided AWRM Costs

Since November 2007, SCVSD, the Ventura County Agricultural Water Quality Coalition, the United Water Conservation District, and the Upper Basin Water Purveyors (including VWC and CLWA) have been working together to develop an AWRM Program to address WQOs associated with the USCR Chloride TMDL. SCVSD is the lead implementation agency for the AWRM.

[5]. The WRP effluent chloride load is comprised of two main sources: chloride present in the blended water supply and chloride added by residents, businesses, and institutions in the Saugus and Valencia WRP service area. The chloride load added by users can be further divided into two parts: brine discharge from self-regenerating water softeners (SRWSs) and all other loads added by users. Excluding the imported chloride load that exists in the water supply, non-SRWS sources of chloride include groundwater; residential, commercial, and industrial water treatment; infiltration; and wastewater disinfection.

The purpose of the AWRM Program is to develop a regional watershed solution for chlorides as an alternative to compliance with the existing 100 milligrams per liter (mg/L) WQO. The AWRM was developed in recognition that compliance with the existing 100-mg/L WQO would be a challenging and costly project, requiring many years to implement. The AWRM Program considers the use of site-specific objectives and water resource management facilities that would allow for full protection of all beneficial uses while simultaneously providing a more feasible compliance solution. The AWRM Program is designed to maintain a chloride balance in the Watershed while providing salt export and water supply benefits to Ventura County stakeholders.

Key elements of the AWRM Program include:

- Implementing measures to reduce chloride in the recycled water produced at SCVSD's Saugus and Valencia WRPs.
- Constructing an advanced treatment facility (i.e., MF/RO) to treat wastewater effluent produced at the Valencia WRP.
- Procuring supplemental water (i.e., local groundwater or surface water) for release to the Santa Clara River to improve water quality and attain WQOs (this would be an interim measure that would be implemented prior to construction of the MF/RO facility and in times of prolonged drought).
- Constructing water supply facilities that would allow for salt export and water supply benefits by blending high-quality Valencia RO product water with more saline groundwater. This would allow for a blended water supply with less than 95 mg/L chloride.
- Providing alternative water supply to protect salt-sensitive agricultural beneficial uses of the Santa Clara River (i.e., by blending irrigation supplies with RO product water).
- Supporting the expansion of recycled water uses within the Santa Clarita Valley.
- Revising the surface water and groundwater WQOs to support all of these elements.

By providing for beneficial use of 910 acre-feet per year (AFY) of tertiary-treated effluent from the Valencia WRP, implementation of the Southern End Recycled Water Project will allow SVCSD to design the AWRM to manage 910 AFY less of wastewater effluent.

The AWRM is expected to be completed by the end of 2015, with construction beginning in 2012. Total estimated capital costs for all AWRM components amount to $250 million. Annual O&M costs associated with the AWRM will be $4,471,830 through 2063 (the end of the Southern End Recycled Water Project's useful life); total present value capital and O&M costs associated with the AWRM will amount to $242,096,644. CLWA estimates that by reducing the amount of wastewater effluent discharged to the Santa Clara River, the Southern End Recycled Water Project will reduce total AWRM capital costs by 2.8%.[6] Thus, total avoided costs as a result of AWRM are $6,875,545.

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[6]. The Valencia and Saugus WRPs treat about 32,000 AFY of wastewater effluent. Thus, the AWRM is designed to accommodate this amount. As a result of the Southern End Recycled Water Project, SVCSD can design the AWRM to treat 910 less AFY of wastewater effluent. 910 AFY is 2.8% of 32,000 AFY.

Avoided Fertilizer Costs

Fertilizing compounds commonly present in recycled water are typically not found in potable water (e.g., nitrogen, phosphorus, potassium). Thus, the use of recycled water for domestic landscape irrigation will reduce fertilizer costs associated with the properties that will be serviced by the project.

The exact offset of fertilizer use from using recycled water is difficult to predict due to daily and seasonal nutrient variations in the recycled water. However, the amount of nutrients (i.e., pounds of fertilizer) per AF of recycled water can be calculated from average effluent values for the Valencia WRP. The recycled water from the Valencia WRP contains 9.5 pounds (lbs) of nitrogen per AF and 50.9 lbs of potassium per AF (data for the amount of phosphorus present in the recycled water is not available). Thus, for every AF of recycled water used in lieu of potable water, VWC recycled water customers will avoid the use of a total of 60.4 lbs of fertilizer. The weighted average commercial value of this fertilizer is $0.324/lb.[7]

For the 910 AF of recycled water applied each year in lieu of imported water, recycled water customers serviced by the project will avoid the use of 54,922 lbs of fertilizer. This will result in avoided costs of $17,795 per year. Over the lifetime of the project, total present value avoided fertilizer costs will amount to $215,557. Additional benefits would be expected for avoided fertilizer costs due to increased levels of phosphorus in recycled water compared to potable supplies.

Avoided Chloride Discharge and Avoided Introduction of Chlorides into the Watershed

Reduced demand for imported water as a result of the proposed project will allow the Watershed to avoid accumulation of 4,369 metric tons (MT) of chlorides over the 50-year project life. In addition, by enabling the use of tertiary-treated effluent from the Valencia WRP for domestic landscape irrigation, the project will avoid the discharge of 7,613 MT of chlorides into the Santa Clara River.

To calculate the avoided importation of chlorides due to reduced future imports of SWP water, it is assumed that the average chloride concentration in SWP water is 79 mg/L[8] (Metropolitan, 2010). Therefore, each AF of SWP water contains 0.097 MT of chlorides, on average.[9] Starting in 2015, avoided imported water use will amount to 910 AFY (in 2014, the project will avoid 455 AF). Thus, the introduction of about 88 MT of chlorides will be avoided each year. Over 50 years, the project will avoid the import of 45,045 AF of SWP water, and 4,369 MT of chlorides will not be introduced into the Watershed.

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[7] This represents the average weighted cost of nitrogen and potassium. Source: Asano, 1981, updated to 2006 using the national fertilizer price index. Updated from 2006 to 2009 based on the Consumer Price Index (CPI).

[8]. This is the highest rolling average value at Metropolitan Water District of Southern California's Jensen Filtration Plant, which is the closest measurement point to CLWA for which data were available. Chloride concentrations in SWP water have ranged from about 28 mg/L to 128 mg/L over the past 30 years (LARWQCB, 2008).

[9]. 1 acre-foot = 1,233,482 liters; 79 mg/L = 97,445,078 mg/AF = 0.097 MT/AF.

To determine the amount of chlorides that will not be discharged from the WRP into the Santa Clara River, it is assumed that the average chloride concentration of recycled water from the Valencia WRP will be 137 mg/L,[10] or 0.169 MT/AF. Thus, each year, the project will avoid the discharge of 154 MT of chlorides (0.169 MT/AF multiplied by 910 AF). Over the 50-year project life, this will amount to the avoided discharge of 7,613 MT of chlorides into the Santa Clara River.

In total, the project will avoid the introduction or direct discharge of 7,613 MT of chlorides. This will reduce chloride loading into the Santa Clara River and improve water quality for beneficial uses.

Reduced CO2 Emissions

By offsetting imported water demands with locally produced water, the project will avoid emissions of CO2 (a greenhouse gas) generated by the production of energy required to transport SWP water to VWC service area.

CO2 emissions resulting from the production of electricity, measured as tons of CO2 per megawatt-hour (MWh), vary by energy source. Hydroelectric power plants are assumed to generate relatively little CO2 emissions, on the order of 0.005 to 0.02 MT/MWh (van de Vate, 2002). For the Pacific region of the United States, CO2 emissions from coal-fired plants and natural gas-powered plants are estimated to be 0.976 MT CO2/MWh and 0.561 MT CO2/MWh, respectively (U.S. DOE and U.S. EPA, 2000). In California, electricity production relies on a range of energy sources, including those located within California and those located outside of the state. The California Department of Water Resources (DWR) estimates that the CO2 emissions rate for all electricity sources providing electricity to the SWP is 0.325 MT CO2/MWh (Climate Registry, 2010).

The California Energy Commission estimates that the electricity required for the conveyance of 1 AF of SWP water imported to Castaic Lake is 1.17 MWh (CEC, 2010). When energy requirements for treatment are taken into account, the total amount of energy required for every AF of water delivered to CLWA and VWC amounts to 1.451 MWh.[11,12]

Using the DWR CO2 emissions rate of 0.325 MT of CO2 emitted per MWh, 0.472 MT of CO2 are produced for every AF of water delivered and treated within the CLWA service area (1.451 MWh/AF multiplied by 0.325 MT/MWh). By eliminating use of 45,045 AF of imported SWP water over the assumed project life, the project will avoid emissions of 21,237 MT of CO2.

Avoided CO2 emissions will be offset to some extent by CO2 emissions from pumping and distributing recycled water from the Valencia WRP to customers. CLWA estimates that 1.001 MWh will be required to produce and deliver 1 AF of the recycled water to VWC customers. In addition,

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[10]. This reflects the average annual concentration reported in the 2009 Valencia WRP Annual Monitoring Report (Sanitation Districts of Los Angeles County, 2009).

[11]. CLWA estimates energy requirements for treatment to be 0.285 MWh/AF.

[12]. Energy required to transmit treated water from CLWA treatment plants to VWC is not included in this analysis due to unavailable data.

the CO_2 emissions rate for the mix of electricity used within the CLWA service area is 0.233 MT CO_2/MWh. Over the 50-year project life, CO_2 emissions associated with recycled water use will amount to 10,506 MT. Thus, with the project, net avoided carbon emissions will be 10,731 MT.

Reduced DBP Precursors

SWP water has a number of water quality constituents that affect its suitability as a drinking water source. SWP water contains relatively high levels of bromide and total organic carbon (TOC), two elements that are of particular concern to drinking water agencies. Bromide and TOC combine with chemicals used in the water treatment process to form DBPs such as trihalomethanes (THMs), which are strictly regulated under the federal Safe Drinking Water Act. Currently, there are no standards for bromide or TOC in drinking water. Water treated by CLWA currently meets all federal and state drinking water standards. However, current levels of bromide and TOC are significantly higher than target levels identified by an expert panel hired by the California Urban Water Agencies. These levels are 50 parts per billion (ppb) for bromide and 3 parts per million (ppm) for TOC. Average SWP levels are significantly higher: up to 600% above the target level for bromide and 10% above the target level for TOC (Owen et al., 1998).

Water agencies treat all water to meet stringent state and federal drinking water standards before delivering it to their customers. However, poor-quality source water makes it increasingly expensive and difficult to meet such standards. Increased levels of constituents that aid in the formation of THMs can mean more time spent monitoring finished water in the distribution system. Increased levels of these constituents may also lead to the use of increased proportions of groundwater in the blend of water supplies in order to control THMs. However, reduced imports of SWP water will reduce the need for such preventative measures.

Reduced Stress on the Sacramento-San Joaquin Delta

By reducing the use of imported SWP water, the Southern End Recycled Water Project will augment future in-stream flows in the Sacramento-San Joaquin Delta or will offset other future diversions that may otherwise reduce flows. Reduced future demands on Delta supplies also will help reduce the overall salinity of the Delta and improve Delta habitat.

Improving the Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports irrigation of 4.5 million acres of agriculture, and serves as home to 750 plant and animal species. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway; 80% of California's commercial fisheries; and recreational uses including boating, fishing, and windsurfing.

Delta resources are in a state of crisis. Fish populations, including salmon and Delta smelt, have declined dramatically in recent years. The levee system is aging, and vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse which would result in devastating impacts to both water supply and habitat.

Distribution of Project Benefits and Identification of Beneficiaries

The Southern End Recycled Water Project includes the full range of types of beneficiaries summarized in Table VWC-1.2. At the local level and regional level, agencies (e.g., SVCSD, VWC, CLWA) and their customers will benefit from reduced AWRM costs and improved downstream water quality due to reduced imports of chlorides. VWC customers receiving recycled water will benefit due to avoided fertilizer costs. Statewide benefits include ecological improvements and improved water quality in the Sacramento-San Joaquin Delta.

TABLE VWC-1.2
PROJECT BENEFICIARIES SUMMARY

Local	Regional	Statewide
SCVSD, VWC	CLWA, Ventura County Agriculture	Sacramento-San Joaquin Delta

Project Benefits Timeline Description

Design efforts for the Southern End Recycled Water Project should be completed by June 2012 and construction will begin in January 2013. Construction is expected to take 18 months, with operation starting in July 2014. For this analysis, a 50-year useful project life is assumed. Thus, benefits and costs are calculated through 2063, 50 years after the project comes online. To calculate avoided costs associated with the AWRM, it is assumed that construction would begin in 2012 and would be completed in 2015. Avoided cost benefits are also calculated through 2063.

Potential Adverse Effects from the Project

The project is not expected to result in any significant adverse effects. The project location is within an urban area that is fully developed.

Summary of Findings

The proposed project will provide a range of both water quality and other benefits. The beneficial use of tertiary-treated effluent from the Valencia WRP will reduce AWRM implementation costs by $6,875,545. VWC recycled water customers will avoid $215,557 in present value fertilizer costs. Reduced use of SWP water will avoid the import of 4,369 MT of chlorides and the effluent discharge of 7,613 MT of chlorides over the 50-year life of the project. In addition, reduced use of SWP water imports will prevent the generation of 10,731 MT of CO2 over the 50-year project life. Additional qualitative benefits from the proposed project include reduced DBPs from SWP imported water and reduced stress on the Sacramento-San Joaquin Delta due to reduced SWP demands.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. These issues are listed in Table VWC-1.3.

TABLE VWC-1.3
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefit	Comment
Avoided AWRM costs	++	Costs of the AWRM are calculated through 2063 to match the project life of the Southern End Recycled Water Project. The AWRM would likely have a useful life of less than 50 years and/or would require replacement costs prior to that time. Replacement costs, which have not been included in this analysis, would serve to increase the avoided (reduced) costs of the AWRM as a result of this project.
Avoided AWRM costs	U	The calculation of the present value costs of the AWRM is a function of the timing of capital outlays and a number of other factors and conditions. Changes in these variables will change the estimate of costs. In addition, the percentage of AWRM costs that the project will avoid is based on current information for AWRM implementation. These assumptions could also change over time.
Avoided fertilizer costs	+	Data for the amount of phosphorus in the recycled water are unavailable. For this analysis the concentration of phosphorus in recycled water is assumed to be zero. With information on phosphorous, benefits of avoided fertilizer costs would likely increase.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

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Electrolysis and Volatilization for Bromide Removal and Disinfectant By-product Reduction Pilot Plant (CLWA-2)

Summary

This project will expand an innovative water treatment technique from a small pilot scale to a demonstration scale that will treat 350,000 gallons per day (gpd) of source water. This new technique, pioneered by the Castaic Lake Water Agency (CLWA), was developed to reduce the level of brominated disinfection by-products (DBPs) in finished drinking water by removing bromide from source waters received from the State Water Project (SWP). Brominated DBPs result from a reaction between naturally occurring bromide anions and disinfectants. CLWA's new treatment technique relies on passing source water through metal anodes where it undergoes both an electrolysis and volatilization process that oxidizes the brominated DBPs into bromine. This reduces the risk of adverse health impacts associated with brominated DBPs. CLWA's pilot project has demonstrated that this treatment technique can successfully reduce levels of brominated DBPs. If the demonstration project is shown to cost-effectively remove brominated DBPs at a greater scale, CLWA will incorporate the existing equipment into a larger project that will treat 7 million gallons per day (MGD), approximately one-half of daily plant wide production.

The benefits of this project can only be properly evaluated based on the full-scale implementation of the innovative technology being demonstrated. Therefore this economic analysis starts by considering the benefits of the larger-scale facility, and then apportions a share of the benefits to the smaller-scale demonstration project. The benefits are apportioned based on the percentage of the full-scale costs represented by this demonstration project.

A summary the benefits and costs of the demonstration project is provided in Table CLWA-2.1. Water quality and other benefits are discussed in the remainder of this attachment.

TABLE CLWA-2.1
BENEFIT-COST ANALYSIS OVERVIEW –DEMONSTRATION-SCALE PROJECT

	Present Value
Costs – Total Capital and O&M	$1,072,533
Monetizable Benefits	
Water Supply Benefits	
Avoided Flushing Due to Nitrification	$147,960
Water Quality Benefits	
Reduction in Chemical Costs	$53,055
Health Benefits From Improved Water Quality	$624,407
Avoided Costs Associated With Switching From Chloramine Treatment to Free Chlorine	$95,173
Total Monetized Benefits	$920,595
Qualitative Benefit or Cost	**Qualitative Indicator***
Water Quality and Other Benefits	

	Present Value
Developing an Innovative New Technique to Reduce Human Exposure to Brominated DBPs	++
More Effective and Flexible Drinking Water Disinfection Treatment	++
Modest Reduction in Influent Levels of Chloride, Ammonia, Brominated DBPs and Nutrients at the Wastewater Treatment Plant	+
Reduced Stress on Sacramento-San Joaquin Delta	+

O&M = operations and maintenance
* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

The "Without Project" Baseline

The Santa Clara River Watershed (Watershed) covers an area of 1,634 square miles in Southern California. Approximately 40% of the Watershed is in Los Angeles County and 60% is located in Ventura County. CLWA is located in the upper portion of the Santa Clara River Watershed in Los Angeles County. Principal tributaries within the upper part of the Watershed include Castaic Creek, Bouquet Canyon Creek, San Franciscquito Creek, and the south fork of Santa Clara River. (LARWQCB, 2010)

CLWA relies on a mix of local ground water and supplemental supplies of SWP water from Northern California to supply local purveyors throughout the Santa Clarita Valley. CLWA receives surface water from Lake Oroville near Sacramento. Source water flows through three power plants once it reaches the Oroville dam before traveling down the Feather and Sacramento Rivers to reach the Sacramento-San Joaquin Delta. Source water then moves through the Delta to the Harvey O. Bank pumping plant where it travels 300 miles south via the CA Aqueduct. Finally, source water reaches A.D. Edmonston Pumping plant where it is pumped south through the West Branch of the California Aqueduct to Quail Lake, Pyramid, Lake and Castaic Lake to be processed by CLWA.

SWP water has a number of water quality constituents that affect its suitability as a drinking water source. SWP water contains relatively high levels of bromide and total organic carbon (TOC), two elements that are of particular concern to drinking water agencies. Bromide and TOC combine with chemicals used in the water treatment process to form DBPs such as trihalomethanes (THMs) and holacetic acids (HAA5s), which are strictly regulated under the federal Safe Drinking Water Act. Currently, there are no standards for bromide or TOC in drinking water. Water treated by CLWA currently meets all federal and state drinking water standards. However, CLWA's use of ozone and chlormaines in the treatment process results in the formation of DBPs such as THMs and HAA5s. Importantly, ozone also interacts with bromide, which naturally occurs in source water, to produce bromate (a brominated DBP), a chemical that may increase the statistical risk of cancer in people who drink water with elevated concentrations.

Without the project, CLWA will continue to receive SWP water with elevated bromide levels, and distribute water that meets current federal and state health standards but has elevated brominated DBPs (notably, bromate). CLWA also will need to retain its current reliance on chloramine disinfection in order to manage DBP levels while concurrently providing suitable microbial control. The continued reliance on chloramines is expensive, limits operational flexibility (e.g., allowing better use of existing ozonation disinfection facilities), and periodically leads to nitrification of the treated water (due to the ammonia levels associated with chloramine production). During episodes of elevated nitirifcation, the finished drinking water cannot be served to the public and instead must be flushed from the distribution system, and replaced with other water.

If the demonstration project performs as anticipated, based on the pilot study, CLWA can move forward with larger-scale implementation of the technology. Thus, this demonstration-scale project is a gateway to the wide range of highly valuable benefits for the CLWA and its retail water purveyors. In other words, the benefits of the demonstration-scale project are integrally linked to the anticipated benefits of full-scale implementation. If the demonstration project performs as anticipated, the benefits will be realized as described in these Attachments 7 and 8, and a portion of the full-scale benefits can be attributed to the demonstration-scale project.

If, on the other hand, the project indicates problems with the technology at the demonstration scale, then the Agency will realize benefits by avoiding the cost associated with full-scale implementation of an approach that does not perform as anticipated from the pilot test alone (e.g., a substantial cost savings will be realized by CLWA by avoiding a poor investment). Or, the limitations made evident by the demonstration project can lead to technology and/or operational improvements that might enhance the new approach and increase its net benefits. These scenarios are not included in this assessment, but they indicate in a qualitative manner how the demonstration project can provide benefits even if it does not perform as well as anticipated.

Water Quality and Other Benefits

This section describes the water quality benefits generated by the development of a full-scale treatment process that will remove bromide from source waters and thus reduce levels of brominated DBPs from finished waters served to the public. The water quality and other benefits include a reduction in chemical costs (potential to switch back to free chlorine disinfection from the current use of chloramines), health benefits associated with improved water quality (reduced public exposure to DBPs), operational benefits associated with switching from chloramine treatment to free chlorine (i.e., more effective and flexible drinking water disinfection treatment), and a decrease in nitrification problems and associated losses of treated water (due to reduced ammonia levels, as required to produce chloramines). Reduced flushing due to nitrification will result in less use of imported SWP water (as described in Attachment 7), and thus a small contribution to reduced stress on the Sacramento-San Joaquin Delta. The demonstration-scale project is then assigned benefits according to the ratio of the costs of the demonstration-scale project to the full-scale project.

Reduction in Chemical Costs

This project will help CLWA to reduce its chemical costs because this treatment technique will allow CLWA to use less chemicals to meet established water quality standards for joint microbial and DBP control. The process of electrolysis and volatilization to reduce brominated DBPs will allow CLWA to reduce the amount of ammonia it uses by 100% and the amount of chlorine it uses by 60%. Based on 2009-2010 expenditures on water treatment chemicals, CLWA spent $42,199 on ammonia and $46,641 on chlorine. A 100% reduction and 60% reduction in the amount of ammonia and chlorine used, respectively, will translate to savings of $70,184 per year. These benefits will last throughout the 30-year lifetime of the full-scale project. The total present value of the reduction in chemical costs resulting from the full-scale plant is $588,972. Attributing a share of these cost savings to the demonstration-scale project (based on the demonstration project having 9.3% of the present value costs of the full-scale facility) results in benefits of approximately $53,055 in present value terms.

Health Benefits From Improved Water Quality

Elevated levels of bromate, a problem currently associated with CLWA's water treatment processes, have been shown to have an elevated statistical cancer risk factor. CLWA's new treatment technique will reduce the concentration of brominated DBPs by 60%. Using a baseline concentration of 8 ug/L, the electrolysis and volatilization technique will reduce the concentration of brominated DBPs by 4.8 ug/L (60% of 8.0 ug/L). When combined with the U.S. EPA statistical cancer risk unit factor of 2.010E-5 for each ug/L, this exposure reduction results in the treatment process avoiding the statistical equivalent of 9.6 cases per 100,000 people exposed (4.8 x 2.0E-5).

This benefit will be substantial with the introduction of the full-scale plant. That is because the full-scale plant will treat 7 MGD, thus reducing the amount of brominated DBPs in water for a large number of customers (260,000 people served). In effect, blending the output of the full facility with the average production at the full plant (21 MGD), the statistical cancer risk reduction is reduced by one-third (or, equivalently, the full 4.8 ug/L reduction in bromate is realized by one-third of the service population, approximately 85,800 (0.33 x 260,000) people benefiting from a reduction in statistical cancer risk. In effect, the entire service area obtaining water from this water treatment plant will see reduced concentrations, but the concentration reduction will be lowered through blending with finished water that has not been treated with the new technology. However, because the dose response function is linear, the mathematical result of the risk assessment is identical if we focus instead on a subset of the population receiving the full bromate exposure reduction.

Using the statistical cancer risk unit factor from earlier in the analysis, we can conclude that the full-scale treatment plant will reduce bromate levels to the statistical equivalent of eliminating 8.24 cases per 70-year "lifetime" (the risk of 0.118 statistical cases per year). Using the standard EPA "value of a statistical life" (VSL, per U.S. EPA 2008) of $7,000,000 per case results in an annual health benefit of $826,000. This annual benefit results in a total present value of health benefits over the 30-year assumed lifetime of the full-scale project of $6,931,630. Attributing a share of these cost savings to the demonstration-scale project (based on the demonstration project having 9% of the present value costs of the full-scale facility) results in benefits of $624,407 in present value terms.

Avoided Costs Associated With Switching from Chloramine Treatment to Free Chlorine

This new treatment technique will allow CLWA to discontinue using chloramine and replace it with less expensive free chlorine. Benefits will result from annual cost savings associated with foregoing purchases of the necessary chemicals to make chloramine, including salt ($13,000) and ammonioum hydroxide solution ($31,800). Additionally, there will be annual cost savings associated with using less electricity ($12,000) and labor ($59,300), both of which are required for

making chloramines. Additional annual cost savings come from avoided purchases of sampling reagents ($4,000) and supplemental sodium hypochlorite ($3,700).
Beyond savings directly attributed to switching to free chlorine, there will be savings associated with not re-pumping water that has undergone nitrification. Nitrification in source water results in an inability to maintain adequate disinfectant residual in treated water. This will often reduce water quality by affecting taste and odor. Much of this water needs to be "flushed" because it cannot be distributed to customers. Using free chlorine would reduce the amount of water flushed, saving an estimated $2,100 in pumping costs per year.

The total annual benefit associated with switching from chloramine to free chlorine is $125,900. The present value of this benefit for the full-scale project is $1,056,528. Attributing a share of these cost savings to the demonstration-scale project (based on the demonstration project having 9% of the present value costs of the full-scale facility) results in benefits of approximately $95,173 in present value terms.

Developing an Innovative New Technique to Reduce Human Exposure to Brominated DBPs

This unique treatment technique, developed by the Castaic Lake Water Agency, has the potential for substantial additional benefits experienced throughout the water utility industry. If the demonstration and full-scale projects are shown to be effective in removing brominated DBPs, this technology could be adopted by a number of water utilities that must treat source water with naturally occurring bromide ions. This will allow water utilities to attain similar benefits such as cost savings in chemical use, along with providing end users with water that is healthier, cleaner, and tastes better. Water utilities that adopt this technology following CLWA's successful demonstration project will also forego any costs associated with innovating redundant treatment techniques. The potential for this project to be utilized by a number of other water utilities facing similar treatment challenges is not quantified in this analysis, though this benefit is expected to be substantial.

More Effective and Flexible Water Disinfection Treatment

While not quantified, the success of the demonstration project and subsequent installation of full-scale treatment will provide CLWA with considerably greater flexibility in its management of its disinfection regime (including ozonation) for microbial control, while simultaneously reducing exposures to DBPs. This additional flexibility will likely reduce costs and improve the overall effectiveness of the utility's operations.

Modest Reduction in Influent Levels of Chloride, Ammonia, Brominated DBPs and Nutrients at the Wastewater Treatment Plant

This new technology will result in a reduction in the concentrations of a number of influents in the source water that must be treated at the wastewater treatment plant downstream from the CLWA. Concentrations of chloride, ammonia, and other nutrients are all expected to decline following the implementation of this technology. This decrease in influent level will make treatment easier and more effective, thus resulting in substantial costs savings at the wastewater treatment plant. Additionally, a decrease in the amount of influent that must be treated will resulted in higher quality effluent being discharged to receiving waters. This will help improve and maintain downstream water quality and beneficial uses. This benefit has not been quantified here.

Reduced Stress on the Sacramento-San Joaquin Delta

By reducing flushing due to nitrification, and reducing the use of imported water (as described in Attachment 7), the full-scale bromide treatment project will modestly augment future in-stream flows in the Sacramento-San Joaquin Delta or will offset other future diversions that may otherwise reduce flows. Reduced future demands on Delta supplies also will help reduce the overall salinity of the Delta and improve Delta habitat.

Improving the Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports irrigation of 4.5 million acres of agriculture, and serves as home to 750 plant and animal species. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway; 80% of California's commercial fisheries; and recreational uses including boating, fishing, and windsurfing.

Delta resources are in a state of crisis. Fish populations, including salmon and Delta smelt, have declined dramatically in recent years. The levee system is aging, and vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse which would result in devastating impacts to both water supply and habitat.

Distribution of Project Benefits, and Identification of Beneficiaries

The bromide removal project includes the full range of beneficiaries, as is shown in Table CLWA-2.2. The key benefits associated with this treatment technique will be realized by the water customers served by the CLWA water treatment facility, who will benefit from reduced health risks. Additionally, CLWA will benefit from this technique because it will allow them to discontinue purchases of chemicals associated with producing chloramines. A reduction in chemical costs will reduce the overall costs of water treatment and allow CLWA to operate more cost-effectively. Reduced flushing due to nitrification (as described in Attachment 7) will result in less stress on the Sacramento-San Joaquin Delta ecosystem. And, potential adoption of this innovative technology by other water utilities that must treat source water with naturally occurring bromide ions will provide benefits statewide and beyond.

TABLE CLWA-2.2
PROJECT BENEFICIARIES SUMMARY

Local	Regional	Statewide
CLWA Santa Clarita Water Division, LA County Waterworks District 36, Newhall County Water District, Valencia Water Company.	Castaic Lake Water Agency Santa Clarita Valley Sanitation District	Sacramento-San Joaquin Delta Other Water Utilities That Treat Source Water With Bromide

Project Benefits Timeline Description

This demonstration-scale project will treat 350,000 gpd for three years, beginning in July 2011 and lasting until July 2014. If this technology proves to be effective, it will be scaled up to a full-scale treatment project capable of treating 7 MGD. Construction of the full-scale project would begin January 2017 and end July 2018. Once the full-scale treatment process has been completed, it will provide water treatment benefits for approximately 30 years.

Potential Adverse Effects from the Project

This technology, which relies on metal anode plates to treat source water, is highly energy intensive. The project will demand greater amounts of energy than the water treatment facility has used in the past. If this energy is not procured from renewable sources, than this project will result in an increase in GHG emissions and the associated carbon footprint of the CLWA. However, reduced GHG emissions from reduced SWP water imports will at least partially offset this effect. Additionally, CLWA is constructing a solar power generation project at the Rio Vista Water Treatment Plant to offset the energy demand of the plant.

Summary of Findings

This project will have a number of water quality related benefits for customers, water purveyors, and the CLWA as shown in Table CLWA-2.3. For the CLWA, this new treatment technique will allow the water utility to reduce its chemical costs. Reductions in the amount of chlorine and ammonia necessary for achieving water treatment standards will result in a present value cost savings of $53,055 over the lifetime of the demonstration project.

In addition to chemical cost savings, this treatment technique will result in monetizable health benefits for customers who drink this water. These health benefits are a result of this project reducing the concentration of brominated DBPs in source water, which have been shown to be a carcinogen when consumed in elevated concentrations. A reduction in the concentration of brominated DBPs will reduce the statistical cancer risk associated with this water. For the demonstration scale project, the present value of health benefits is expected to total $624,407.

Finally, CLWA will also be able to switch treatment chemicals from more expensive chloramines to more affordable free chlorine. Switching from chloramines to free chlorine will result in a present value cost savings of $95,173 over the lifetime of the demonstration project.

Beyond these monetized benefits, there are a number of qualitative benefits associated with this project that are difficult to completely value. Most importantly, this project will also be instrumental in developing an innovative new technique to reducing human exposure to brominated DBPs in source water. If proven to be effective, this technology could be deployed at a large scale in a number of watersheds that have naturally occurring bromate ions. Therefore, the benefits of this project could include the introduction of an innovative treatment technique to a number of water utilities. These benefits also include the increased operational flexibility for CLWA from development of a more effective and flexible drinking water disinfection treatment technique. This project will also result in modest reductions of influent levels of a number of chemicals, including chloride, ammonia, and other nutrients, at wastewater treatment plants. This will result in cost savings for the wastewater treatment plant, in addition to an improvement in the quality of effluent discharged back into receiving waters. Also, reduced flushing due to nitrification (as described in Attachment 7) will result in less stress on the Sacramento-San Joaquin Delta ecosystem.

TABLE CLWA-2.3
QUALITATIVE BENEFITS SUMMARY – WATER QUALITY AND OTHER BENEFITS

Benefit	Qualitative Indicator
Developing an Innovative New Technique to Reduce Human Exposure to Brominated DBPs	++
More Effective and Flexible Drinking Water Disinfection Treatment.	++
Modest Reduction in Influent Levels of Chloride, Ammonia, Brominated DBPs, and Nutrients at the Wastewater Treatment Plant.	+
Reduced Stress on Sacramento-San Joaquin Delta	+

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the attribution of demonstration-scale benefits to full-scale implementation. This issue is discussed in Table CLWA-2.4.

TABLE CLWA-2.4
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Basing demonstration-scale benefits on a cost-based percentage of the benefits of full-scale implementation of the innovative bromide control technology	U	The benefits of the demonstration-scale project are linked to the anticipated benefits of full-scale implementation. If the demonstration project performs as anticipated, the benefits will be realized as described in Attachments 7 and 8. If the project indicates problems with the technology at the demonstration scale, then the Agency will realize benefits by avoiding full-scale implementation of an approach that does not perform as anticipated from the pilot test alone (e.g., a substantial savings from avoiding a poor investment), or can lead to technology improvements that enhance the new approach and its net benefits.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

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Santa Clara River, San Francisquito Creek Arundo and Tamarisk Removal Project (SC-1/USFS-1)

Summary

The Santa Clara River Arundo and Tamarisk Removal Plan (SCARP) identifies programs and projects that will most effectively remove arundo, tamarisk, and other invasive plants from the Upper Santa Clara River. Implementation of the SCARP within the Upper Santa Clara River Watershed (Watershed) will be conducted in two phases. Phase 1 of the project will remove arundo and tamarisk in the site specific implementation area (Project Area 1), which includes approximately 297 acres. Phase 2 of the project will continue the removal of arundo and tamarisk outside of Project Area 1, up into City- owned reaches along San Franciscquito and Bouquet Canyon Creeks, and eventually into Angeles National Forest.

The Santa Clara River, San Francisquito Creek Arundo and Tamarisk Removal Project will finish the implementation of the Santa Clarita Site Specific Plan (SSP), and move SCARP into the Santa Clara River Long Term Implementation Plan. The project will implement Phases D through G of the SSP, which includes the removal of arundo and tamarisk within roughly half of the total SSP project area (about 150 of the 297 acres). In total, 20 acres of arundo and tamarisk will be removed from targeted locations throughout the 150-acre project area.

Two types of restoration efforts will be employed to ensure effective eradication of the invasive species. The first effort will include non-native biomass removal and herbicide application. Arundo may be ground in place with mechanical equipment such as a brush grinder (where appropriate), or removed by manual means employing tools such as chainsaws and brush cutters. Herbicide application will ensure after removal. After this initial treatment, a diligent monitoring and maintenance program will be implemented to facilitate re-treatments, and avoid re-infestation of the site.

Native species common to this area such as willows (Salix sp.) and mule fat (Baccharis salicifolia) will reestablish readily through natural recruitment once competition from non-native species is removed. Additionally, native plant restoration will ensure reestablishment in areas that require more rapid enhancement than natural recruitment can provide.

A summary of all benefits and costs of the project are provided in Table SC-1.1. Water quality and other benefits are discussed in the remainder of this attachment.

TABLE SC-1.1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs	$648,310
Monetizable Benefits	
Water Supply Benefits	
Avoided Imported Water Costs	$674,560
Total Monetized Benefits	$674,560
Quantified Benefit or Cost	**Project Life Total**
Water Supply Benefits	
Increased Water Supply Reliability	+
Improved Operational Flexibility for CLWA	+
Water Quality Benefits	
Improved Surface Water Quality	++
Reduced Salt Loading	+
Decreased Streambank Erosion	++
Reduced DBP Precursors	++
Reduced Stress on the Sacramento-San Joaquin Delta	++
Restoration of Native Habitat	+
Reduced Fire Hazard	+
Reduced CO2 Emissions	+
Reduced Stress on the Sacramento-San Joaquin Delta	
Increased Educational Opportunities	++
Flood Control Benefits	++
Reduced Flooding Incidence	+

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

The "Without Project" Baseline

The Santa Clara River Arundo and Tamarisk Removal Project will be located near the City of Santa Clarita, within the Upper Santa Clara River Watershed. The project area includes a highly visible 150-acre reach of the Upper Santa Clara River (USCR), and the lower reaches of two major tributaries just above the confluence of San Francisquito Creek and the South Fork of the Santa Clara River.

The Santa Clara River is the largest river system in Southern California that is still in a relatively natural state. The river originates on the northern slope of the San Gabriel Mountains in Los Angeles County, traverses Ventura County, and flows into the Pacific Ocean between the cities of San Buenaventura (Ventura) and Oxnard. Municipalities within the Watershed include Santa Clarita, Newhall, Fillmore, Santa Paula, and Ventura (LAWQCB, 2006).

Extensive patches of high-quality riparian habitat exist along the length of the river and its tributaries. Two endangered fish, the unarmored stickleback and the steelhead trout, are resident in the river (LAWQCB, 2006). One of the Santa Clara River's largest tributaries, Sespe Creek, is designated a Wild Trout Stream by the State of California and a Wild and Scenic River by the U.S. Forest Service. Piru and Santa Paula creeks, tributaries to the Santa Clara River, also support steelhead habitat. In addition, the river serves as an important wildlife corridor. The Santa Clara River drains to the Pacific Ocean through a lagoon that supports a large variety of wildlife.

Since the 1970s, growth in the Santa Clarita Valley has led to chloride and nutrient levels that exceed water quality objectives (WQOs) and impair beneficial uses for agricultural supply, groundwater recharge, and rare and endangered species habitat. As a result of these factors, a total maximum daily load (TMDL) for chlorides has been established for the Watershed. In 2004, the reach of the river affected by this project was also listed for nutrient impairment. Algae problems resulting from excess nutrients have been documented throughout the watershed. Segments of Santa Clara River and its tributaries are also impaired by ammonia, nitrate and nitrite and are included on the California 2002 303(d) list of water quality limited segments. Additionally, one segment of the Santa Clara River is included on the State Monitoring List for organic enrichment/low dissolved oxygen. Two segments of the Santa Clara River are included on the State Enforceable Programs list for ammonia with one of those segments also listed for nitrite as nitrogen (LAWQCB 2003).

Estimates for the broader SSP project area indicate that infestation by arundo, and to a lesser extent tamarisk, is pervasive, extending throughout the site. Arundo infestations are particularly dense in the site's western (downstream) and central reaches, where large areas of the main stem exhibit historic infestation levels of 51 to 75% cover. While arundo historically tends to exhibit lower density infestation levels in the site's upstream areas, large areas are still infested, with significant areas of 26 percent to 50 percent arundo cover. Tamarisk infestations are concentrated in the east (upstream) portions of the SSP project area. These infestations typically range from 1 percent to 50 percent cover. Project Phases D through G (covered under this grant proposal) are located within the western portions of the SSP project area.

Both arundo and tamarisk consume large amounts of water, which negatively affects both instream and groundwater availability. Reduced water availability also adversely affects water-dependent plants and wildlife, and reduces the water available for beneficial municipal and agricultural uses. Although native riparian plants have similar transpiration rates per unit of surface area to arundo and tamarisk, arundo and tamarisk have approximately two or more times greater leaf surface area. Therefore, they transpire more water than native plants (VCRCD 2006 from Kelly 2003). Water consumption by these species is so high that dense infestations can desiccate riparian areas (seeps, springs, rivers) in arid habitats (VCRCD 2006 from Egan and Walker 2000; Dudley 2000).

Without the project, arundo and tamarisk will continue to spread, covering a greater percentage of the watershed. The expansion of these species will have a negative impact on water quality and riparian habitat in the project area and the watershed in general. Increased arundo and tamarisk will result in a reduction in the shading of surface water, thereby resulting in reduction of bank-edge river habitat, high water temperature, lower dissolved-oxygen content, elevated pH, conversion of ammonic to toxic unionized ammonia, and increasing soil salinity from leaf matter. Increased erosion of streambanks, and associated damage to habitats and farmlands, will also continue to increase. These factors will not only result in adverse water quality impacts, but will adversely affect native habitat. In addition, increased arundo in the project area will result in substantially increased danger of wildfire occurrences, intensity, and frequency.

Water Quality and Other Benefits

The project will provide a range of water quality and other benefits. This section provides discussion and details on benefit estimation for benefits including: improved surface water quality, reduced salt loading, decreased stream bank erosion, restoration of native habitat, reduced fire danger, and increased educational opportunities related to arundo and tamarisk removal.

Improved Surface Water Quality

Being a giant grass, Arundo provides little shade along the river compared to native vegetation such as willows, sycamores, and live oaks, which have strong branches that can support wide spreading growth habitat, and/or large leaves that shade streamside habitats in the summer.

Where Arundo is dominant, the lack of shade causes water temperatures in the river to increase compared to areas where native vegetation is dominant, which can ultimately lead to a reduction in dissolved oxygen, making the water unsuitable for aquatic organisms (VCRCD 2006 from Bell 1997). In addition, increased light exposure and temperature may encourage algal blooms, which can increase pH levels and severely reduce available habitat for aquatic organisms (VCRCD 2006 from Adamus et al. 1997). Increased pH also facilitates the conversion of usable ammonia to a toxic byproduct, which degrades water quality. All of these changes can adversely affect beneficial uses of the river, including habitat for rare and sensitive species.

Reduced Salt Loading

Tamarisk deposits concentrated salt from its leaves to the soil. This salt originates from the soil and from deeper aquifers, as its taproot can bring up water from 100 feet deep. When these leaves drop, increased soil salinity and salts are deposited into adjacent creeks due to salt transport during runoff. Native plant species are further impacted because they generally cannot tolerate tamarisk's contribution to soil salinity, while arundo can.

There have been millions of dollars spent to reduce the chloride level in the Santa Clara River below 117 mg/l. Any amount of chloride in the ambient river is not considered "normal". Therefore, any additional chloride salts in the river will need to be offset by additional mechanical removal at the sewage treatment plants. A group of local stakeholders have been working together to develop a program to address WQOs associated with the USCR Chloride TMDL. The cost for that program has recently been estimated at $250 million, including cost to build and operate a reverse osmosis plant to remove chlorides. The community has also spent many millions of dollars removing water softeners that were adding tons of chlorides to the sewage treatment plants' recycled water quality effluent. While the overall chloride content is small from individual trees, adding even small amounts of salt is compounding an already difficult situation.

Decreased Streambank Erosion

Both arundo and tamarisk are known to increase the potential for erosion of adjacent lands along the Santa Clara River. Both plants can alter stream geomorphology by trapping and stabilizing sediment, which narrows stream channels, widens floodplains, and causes increased flooding (VCRCD 2006). Large stands of arundo and tamarisk may also obstruct flows and shunt floodwaters into areas that historically have not experienced water flow. This can exacerbate bank erosion problems and lead to an unnatural increase in the loss of adjacent public and private property that is often valuable farmland (VCRCD 2006).

Reduced Fire Hazards

Both arundo and tamarisk contribute to increased fire hazards. Under natural conditions, riparian areas act as firebreaks, but as they are overcome by invasive species, they not only enable wildfires to spread more rapidly, but they can also become sites where fires may originate. Arundo, in particular, is highly flammable and burns more intensely than native riparian vegetation even when green (VCRCD 2006 from Bell 1997; Dudley 2000).

Several accounts have suggested that infestations of Arundo have increased fuel loads as well as fire frequency and intensity along riparian corridors. Growing from 13 to 26 feet in height, and as fast as 4 inches per day (Coffman et. al. 2010), Arundo produces abundant flammable biomass that accumulates during the summer and fall months (Coffman et. al 2010 from Rundel 2000). Further, several researchers have suggested that fire may increase the ability of Arundo to invade natural riparian systems (studies identified in Coffman et al. 2010), and that it may be part of an invasive plant-fire regime cycle, changing riparian ecosystems from primarily flood-defined to fire-defined systems (Coffman et. al. from Bell 1997).

Coffman et. al. 2010 evaluated the influence of wildfire on Arundo invasion by investigating its relative rate of reestablishment versus native riparian species after the Simi/Verdale wildfire burned 300 ha of riparian woodlands along the Santa Clara River in October 2003. Post-fire Arundo growth rates and productivity were compared to those of native woody riparian species in plots established before and after the fire. The researchers found that Arundo resprouted within days after the fire, and exhibited higher growth rates and productivity compared to native riparian plants. One year post-fire, Arundo density was nearly 20 times higher and productivity was 14–24 times higher than for native woody species.

The study concludes that the greater dominance of Arundo after the wildfire increased the susceptibility of riparian woodlands along the Santa Clara River to subsequent fire, potentially creating an invasive plant-fire regime cycle. Decreased moisture content and increased surface-to-volume ratio of Arundo versus native vegetation may lead to altered or increased fire susceptibility or increased probability of ignition in these systems. Addition of this fuel to the riparian ecosystem has increased vertical continuity (i.e., the structure of fuel allows fire to spread from surface to crowns of shrubs and trees). Due to its tall growth form, infestations of Arundo mixed with native species may spread fire vertically into the canopy of riparian trees.

The October 2003 Simi/Verdale wildfire provides an excellent example of the invasive plant-fire regime cycle that Arundo invasion has created. The wildfire reached the Santa Clara River from the north, crossed the broad riverbed through large stands of Arundo, then burned through thousands of hectares of native shrublands and non-native grasslands before again entering extensive riparian woodlands intermixed with Arundo to the west along the river. Without the presence of arundo, it is believed that the Santa Clara River would have served as a better fire break, and the fire would not have burned as many acres.

Restoration of Native Habitat

Arundo and tamarisk threaten native riparian habitats and the wildlife that depends upon these habitats by excluding native plants from water resources, growing space, and sunlight. Arundo often forms dense monocultures that exclude native vegetation by monopolizing water resources, shading, and altering flood regimes critical to the establishment of native riparian vegetation (Bell 1997 ; Dudley 2000). The salt-laden leaf litter of tamarisk also precludes such native understory from establishing. Both plants do not offer the same amount of shade as native vegetation (Carpenter 1998).

Both arundo and tamarisk reduce habitat quality and food supply for native wildlife, including insects and bird species (Bell 1997 ; Dudley 2000; Herrera 2003). Insects and other grazers are not able to use arundo as a food source due to the noxious chemicals it contains and its defensive cellular structure (Bell 1997). This is particularly important for federal and state listed species, such as least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo, which utilizes insects as a food source. Documented decreases in wildlife usage of riparian areas have occurred due to massive stands of arundo (Dudley 2000).

Based on a review of pertinent literature and of historical sensitive plant species locations identified in the California Natural Diversity Database (CDFG 2002), a total of 19 special status plant species and 21 special status wildlife species have the potential to occur within the broader SCARP project area. Of these 21species, eight are federally listed under the Federal Endangered Species Act (FESA). Specific species of concern associated with this project include the unarmored three-spine stickleback, western pond turtle and red legged frog.

Removal of arundo and tamarisk, and native plant reestablishment through this project will allow restoration of high quality habitat in the project area.

Reduced CO2 Emissions

By offsetting imported water demands with locally produced water, the project will avoid emissions of CO_2 (a greenhouse gas) generated by the production of energy required to transport SWP water to the CLWA service area.

CO2 emissions resulting from the production of electricity, measured as tons of CO2 per megawatt-hour (MWh), vary by energy source. Hydroelectric power plants are assumed to generate relatively little CO2 emissions, on the order of 0.005 to 0.02 MT/MWh (van de Vate, 2002). For the Pacific region of the United States, CO2 emissions from coal-fired plants and natural gas-powered plants are estimated to be 0.976 MT CO2/MWh and 0.561 MT CO2/MWh, respectively (U.S. DOE and U.S. EPA, 2000). In California, electricity production relies on a range of energy sources, including those located within California and those located outside of the state. The California Department of Water Resources (DWR) estimates that the CO2 emissions rate for all electricity sources providing electricity to the SWP is 0.325 MT CO2/MWh (Climate Registry, 2010).

The California Energy Commission estimates that the electricity required for the conveyance of 1 AF of SWP water imported to Castaic Lake is 1.17 MWh (CEC, 2010). When energy requirements for treatment are taken into account, the total amount of energy required for every AF of water delivered to CLWA amounts to 1.451 MWh.[13,14]

Using the DWR CO2 emissions rate of 0.325 MT of CO2 emitted per MWh, 0.472 MT of CO2 are produced for every AF of water delivered and treated within the CLWA service area (1.451 MWh/AF multiplied by 0.325 MT/MWh). By eliminating use of 3,100 AF of imported SWP water over the assumed project life, the project will avoid emissions of 1,463 MT of CO2.

Avoided CO2 emissions will be offset to some extent by CO2 emissions from pumping newly available groundwater within the project area. The energy required to pump groundwater is unknown, thus, net avoided emissions cannot be calculated. However, due to the high energy requirements associated with importing water, the project will result in a net avoided emissions of CO2.

Reduced Stress on the Sacramento-San Joaquin Delta

By reducing the use of imported SWP water, the Arundo and Tamarisk Removal Project will augment in-stream flows in the Sacramento-San Joaquin Delta or will offset other diversions that may otherwise reduce flows. Reduced future demands on Delta supplies also will help reduce the overall salinity of the Delta and improve Delta habitat.

Maintaining the Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports irrigation of 4.5 million acres of agriculture, and serves as home to 750 plant and animal species. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway; 80% of California's commercial fisheries; and recreational uses including boating, fishing, and windsurfing.

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[13]. CLWA estimates energy requirements for treatment to be 0.285 MWh/AF.

[14]. Energy required to transmit treated water from CLWA treatment plants to CLWA retail water purveyors is not included in this analysis due to unavailable data.

Delta resources are in a state of crisis. Fish populations, including salmon and Delta-smelt, have declined dramatically in recent years. The levee system is aging, and vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse which would result in devastating impacts to both water supply and habitat.

Increased Educational Opportunities

The project will be located within the City of Santa Clarita in a highly visible area bordered by recreational trails. This will provide the City to demonstrate a natural resource management project to the public, and increase public awareness of problems associated with invasive species.

Distribution of Project Benefits, and Identification of Beneficiaries

The Santa Clara River, San Francisquito Creek Arundo and Tamarisk Removal Project includes the full range of types of beneficiaries, as shown in Table SC-1.2. At the local level, farmers and other property owners along the river will benefit from reduced streambank erosion and reduced fire danger. Local residents will also benefit from increased knowledge and education regarding invasive species. At the regional level, residents of the Santa Clara River Watershed will benefit from improved water quality, restoration of native habitat, and reduced CO2 emissions. Residents will benefit from reduced fire hazard, as fires in California can put a strain the State's financial resources. At the state level, residents will also benefit through the restoration of habitat for species of statewide significance and reduced stress on the Sacramento- San Joaquin Delta.

TABLE SC-1.2
PROJECT BENEFICIARIES SUMMARY

Local	Regional	Statewide
Santa Clara River property owners and nearby residents, Local Water Retailers	Santa Clara River Watershed residents (improved water quality, restoration of native habitat, reduced CO2 emissions, reduced fire hazard)	Sacramento-San Joaquin Delta

Project Benefits Timeline Description

Project implementation will be completed in December of 2012, with some administration and monitoring activities taking place through 2015. A 50-year useful project life is assumed for this analysis. Thus, benefits are calculated through 2062 (50-years after the project begins providing benefits in 2013).

Potential Adverse Effects from the Project

The Santa Clara River, San Francisquito Creek Arundo and Tamarisk Removal Project may have short-term negative impacts during removal work, but steps will be taken to avoid long-term disturbance to habitat and native species living in the area. A CEQA document is being prepared and will address any potential adverse impacts.

Summary of Findings

The proposed project will provide a range of both water quality and other benefits. Although none of these benefits are quantifiable, they serve to significantly increase the value of the proposed project. These benefits include improved surface water quality, reduced salt loading, decreased stream bank erosion, restoration of native habitat, reduced fire hazard, and increased educational opportunities related to arundo and tamarisk removal.

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